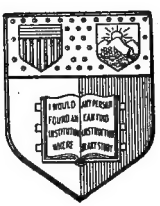

New Edition, Revised and Enlarged.

THE

SORGHUM HAND BOOK:

A TREATISE ON THE

Sorgho and Imphee Sugar Canes,

THEIR CULTURE AND

MANUFACTURE INTO SYRUP AND SUGAR

AND VALUE FOR FODDER.

CINCINNATI, OHIO, U. S. A.

THE BLYMYER IRON WORKS CO.

JAN. 1, 1888.

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INTRODUCTORY.

SORGHUM, since its first introduction into the United States in 1854, has passed through several critical stages. The new plant was heralded with a flourish of trumpets, and the expectations of the farmers of the North and South excited to the utmost by the representations made of its remarkable qualities and value. Not only was syrup of the best quality promised, but sugar *ad libitum*. All the farmer had to do was to plant a few acres and he was to have syrup and sugar in proportion, and a ready market at high prices. Even the intrinsic value of the plant for forage, etc., was exaggerated beyond all moderation. Thousands all over the country rushed into the cultivation of the new gold-bearing plant, and the result was sharp and decisive. With little or no knowledge of the plant itself, or the proper culture thereof, and totally without experience as to its manufacture into syrup and sugar, and with no proper appliances or machinery, millions of gallons of black, unpalatable syrup were made, glutting and destroying the home market, and finding, of course, no sale in the general market. Thus heralded, thus introduced, and thus maltreated, Sorghum was, after the first four years' trial, generally considered a failure, and its cultivation was as rapidly abandoned as taken up.

About this time (1858) appeared an invention of an Ohio farmer (Mr. D. M. Cook, of Richland County,) the Cook Evaporator, of simple and scientific construction, which, in the hands of Blymyer, Bates & Day, of Mansfield, O., was energetically introduced throughout the country. (This invention, by the way, has never been equalled or excelled, save by an improved machine, first introduced a few years ago by the Blymyer Manufacturing Co., called the "Automatic Cook Evaporator.")

Later on, the war between the Federal Government and the Southern Confederacy broke out, the price of syrup rose to a high figure, and as it had become known throughout the North that an excellent Sorghum syrup could be made on the Cook Evaporator, new life was infused into Sorghum, and its manufacture became a great industry.

After the war, prices of syrup going down under competition with other syrups, and the domestic market being glutted with the immense production, Sorghum was once more on the wane, and although it remained a most important article of domestic manufacture and consumption, it slowly retrograded.

About 1872 the attention of the country was again directed to Sorghum, through the introduction of new varieties, particularly the Early Amber, and a new impetus was given to the industry. From then on until 1882 the attention of the country was once more fixed on Sorghum. Great and extravagant hopes were excited in regard to the production of sugar. The Agricultural Department took it up, and, by its general deductions from insufficient data, enkindled an enthusiasm that amounted to a craze. It seemed as if all the scientific visionaries and enthusiasts of the country had started out preaching the new gospel. Not content with sugar from Sorghum, it was to be produced from corn, so as to defy competition from the world. In vain did the true friends of Sorghum call a halt, and point out the wildness of the theories promulgated, and the entire failure which must result. The craze went on and a vast amount of money was lost and many planters ruined.

Sorghum received at the hands of its injudicious friends, the scientific enthusiasts (and we must not overlook the cheats, who, for gain, played on popular credulity), a blow that threatened its destruction. Its present recovery and revival on a strong, sure footing, but illustrates the intrinsic value of the plant, since it rises above all its misfortunes.

The outlook for Sorghum was never really so promising as now. The enthusiasts and visionaries, who nearly ruined it by exciting false and ungrounded hopes, and the parasites who aimed to make their fortunes out of the great expectations excited have been silenced and repudiated.

Whilst the hope of making sugar from Sorghum profitably has not been abandoned, the reasonable expectation of cane growers is now to supply the domestic market with syrup, and to establish prices in the general market on a paying basis that will use up all of the surplus. More reasonable confidence is being shown now by cane growers in the future of Sorghum than ever before, as is evidenced in the large addition made yearly to the number of plants of good machinery throughout the whole country. Sorghum fortunately is now out of reach of impractical theorists and humbugs, and is receiving the attention it deserves from the practical intelligence of cane growers.

Figuratively speaking, although nearly choked to death by the weeds. Sorghum is now far enough along to get the better of them, and is able to take care of itself.

The value of the plant for fodder is again coming into prominence, and it is beginning to be realized by many that, all things considered, there is no crop that the farmer can grow that will yield him a better return. Now that it is understood that syrup, to find a market, must be good, and that the plant has great value for fodder, we may expect that Sorghum will become one of the great staples of the country, and for the future will experience no more vicissitudes than all others of the great crops are liable to.

SORGHUM.

The Chinese and African Sugar Canes.

VARIETIES, CULTURE AND MANUFACTURE.

The name Sorghum in its comprehensive meaning embraces not only the sugar producing varieties (Sorghum Saccharatum), but, also, the numerous grain bearing plants (Sorghum Vulgare). Sorghum is one of the oldest plants known to history. There is good reason for believing that it was cultivated in China as far back as 2,000 years before the Christian era, and it has certainly been grown in various parts of Asia and Africa from a remote antiquity. Its cultivation in Europe is of much later date; but there is some evidence to show that it has been grown in Italy, and other parts of Europe from as early as the first century. It has been cultivated from the earliest times for bread, feed for horses and cattle, for alcoholic drinks, and for its saccharine properties.

Under the general name of Sorghum in this treatise, we include only the different sugar producing varieties of the Sorgho and Imphee canes. The Sorghos are commonly known as the Chinese canes, because the varieties first introduced into this country came originally from China; whilst the Imphees, first coming from Africa, are known as the African canes. The Sorghos and the Imphees are supposed to have had a common origin, and although the place of their nativity is not certainly known, it is believed by most authorities to have been India.

Sorghum was first introduced into France in 1851 by the Count de Montigny, then French Consul at Shanghai, China, who sent from there to the Geographical Society of Paris a quantity of Sorghum seed, together with a collection of other seeds and plants. In the same year Mr. Leonard Wray, whilst visiting a colony in Natal, in Africa, found there a plant called by the Zulu-Kaffirs, Imphee, "the sweet plant." He collected seed of all the varieties known to the natives, fifteen in all, and planted some of each, and sent some to the Geographical Society of Paris. Mr. Wray was so impressed with the importance of his discovery, that he soon went to Europe, for the purpose of making known to the world the value of the plant. It is mainly to his efforts, and those of Mr. Louis Vilmorin, of Paris, that is due the general recognition of the value of Sorghum that soon prevailed.

In 1854 the agent of the United States Patent Office, who had visited Europe for the purpose of procuring seeds for the Agricultural Department, returned to this country, bringing with him a quantity of Sorghum seed. This seed was distributed by the Patent Office to various parties in the North and South, and during the following year it was planted and then cultivated and made into syrup and sugar. Reports were made to agricultural societies demonstrating its value, a general interest was created in the plant, and thus it obtained its foothold in the United States.

SORGHUM FOR FORAGE.

From the earliest period of the world's history, the different varieties of Sorghum have been used as food for man and beast. It is now the principal grain food in Africa, in large sections of Asia, and is largely cultivated in Southern Europe. The seed is made into bread and mush for man, and the seed and leaves used for forage for horses, mules and cattle. In the United States, on account of the special attention given to the plant as a producer of syrup and sugar, its other merits have been overlooked or underestimated. Whilst here, for the most part, it is grown only for syrup or sugar, fully nine-tenths of the Sorghum cultivated in the world is for the seed and the leaves for food and forage.

Chemical analysis has demonstrated that the chemical composition of Sorghum seed is substantially the same as that of corn, and experience has fully shown that for feeding and fattening purposes Sorghum is fully the equal of corn, and may be substituted for it. It is also established that the amount of Sorghum seed that an acre will produce equals in quantity the corn that may be made from the same land. The seed and leaves then will alone well pay for the cultivation of Sorghum; and as the time for cutting cane for syrup allows the seed to come to sufficient maturity, the planter may have the stalks for syrup free of cost. When the value of Sorghum is fully realized in its relation to food and forage, it will be much more widely planted than now in this country, the greater part of which is so well adapted to its successful cultivation.

SORGHUM FOR SYRUP.

Sorghum has been cultivated in the United States chiefly for syrup and sugar. In many sections of the country the domestic consumption of syrup is almost wholly confined to Sorghum, and there is no state or territory, with the exception of New England, in which Sorghum syrup does not form an important product.

It is beginning to be understood that a market can readily be found *at home* for a *good* article of syrup, and as none else is wanted, its manufacture is gradually coming into the hands of those who are willing to give the requisite care to the selection of seed, the culture of the cane, and who have the apparatus needed to produce good results.

Thousands of operators throughout the country now make Sorghum syrup equal in appearance and taste to the best refined syrup, and make money every year in the business. Many of them starting with small horse-power outfits, have enlarged their plants year to year, until they have steam-outfits that cost from $5,000 to $6,000, or more, and make money.

SORGHUM FOR SUGAR.

Under favorable conditions, and with the proper appliances, sugar can be readily made from Sorghum. It has been made in greater or less quantity by many operators throughout the country every year since 1858. Sugar making from Sorghum has not yet, however, proven a profitable business; on the contrary, wherever undertaken on a large scale it has been a money losing operation. The operator does not merely want to be assured that he can *make sugar*, but that by making sugar he can *make money*. We have, therefore, always cautioned those who sought our advice, that whilst it might prove in the end that money could be made out of sugar making in the North, it was by no means certain, and that it was best to go slow.

Sorghum is a crop already of immense value to the North, and it is capable of being developed into one of the most valuable of all the crops; but this desirable end cannot be secured by giving it a fictitious value. It pays to plant Sorghum now for syrup and fodder, and will pay still better when all the valuable properties of the plant are recognized and made use of.

If Sorghum growing in the North was general in all sections where climate and soil are favorable, and the best machinery and skill used in its manufacture into syrup, Sorghum syrup would soon monopolize the home market, and in the end bring its value in the general market.

There would be at times in some sections an overproduction in this crop, as in all others, that would make it temporarily unprofitable; but this would regulate itself, as in other crops. There is no question but that much more can be made out of Sorghum than has yet been made. Many experienced cane growers are hopeful that it may yet be shown that the crop may be grown for sugar profitably.

In *favorable seasons* and localities, perhaps *sugar* can be made *profitably*, and where the investment is not so great as to make success *dependent on making the whole crop into sugar every season*, whether favorable or not, it may be a reasonably safe risk.

Whilst then it may yet be demonstrated that Sorghum may be grown profitably for sugar alone, for the present at least the chief reliance must be in the production of a good quality of syrup.

We are not as yet prepared to accept the enthusiastic prediction of Dr. Collier, in the preface of his valuable book on Sorghum, that "the Sorghum plant is destined, sooner or later, to furnish not only all the sugar needed in this country, but also a very considerable portion of that required by foreign nations."

VARIETIES OF SORGHUM.

The Sorghum Sugar Canes are generally classified into two great divisions—the Sorghos and the Imphees; the former chiefly of Asiatic origin, and in general distinguished by expanded panicles, more or less drooping; and the latter exclusively of African origin, by closely contracted and erect panicles. The Imphees and the Sorghos have been crossed, and the resulting hybrids intercrossed, until numerous varieties have been produced, more or less resembling each other, and possessing similar properties in common to a greater or less extent. These varieties again have been subjected to the natural modification resulting from the various conditions of soil and climate to which they have been exposed. The difficulty, then, of assigning these numerous varieties to their proper class, is plain.

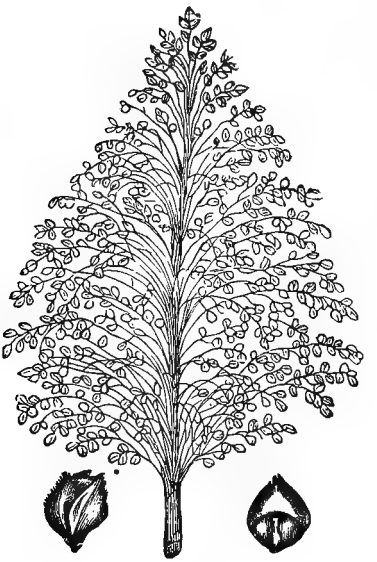
In general, the Regular Sorgho, Honduras, Mastodon, and other varieties with expanded panicles, may be classed as Sorghos, and the Liberian, Neeazana, Early Amber and Early Orange, and other varieties with close panicles, may be ranked as Imphees. We give in the following pages a number of illustrations, by the help of which cane growers will be assisted in classifying their own varieties. Some of these varieties go under different names in different localities.

The engravings on the opposite page accurately represent some of the varieties of Sorghum grown for a number of years in Southern Ohio, under our own care, for the purpose of supplying ourselves with pure seed. We have long since discontinued handling seed.

These engravings show the appearance of the various seed heads, and of the seed, the latter being full size, both naked and enclosed in its glumes.

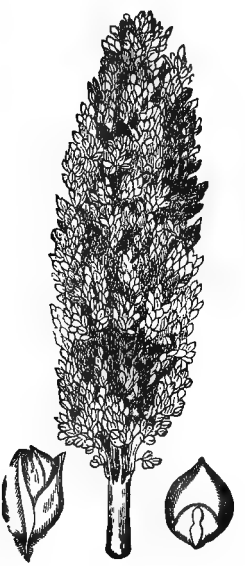
The stalk of the regular Sorgho, or original Chinese sugar cane, is tall and tapering, more slender than corn, and more graceful in appearance. It grows to the height of ten to twelve feet or more. The stalk is not so thick as the Imphees. As the plant approaches maturity a whitish efflorescence appears upon the parts underneath the footstalks of the leaf. The time required for the full development of the cane is about five months; but this depends of course largely on the soil, climate and season.

The cuts show correctly the appearance of the seed-head and seed of two of the Imphees or African sugar canes. The seed is represented both naked and as inclosed in its glumes. It will be noticed that the seed-heads of the Imphees are much more compact than the Sorgho. The color of the Oomseeana seed is a dark brown, whilst that of the Liberian is a deep red. The Neeazana is another variety of the Imphee. It does not differ very widely in its appearance from the Liberian, but the seed is a cream or wood color. "The Neeazana," says Mr. Wray, "was held by Zulu-Kaffirs (natives of the Southeast Coast of Africa, from whence the different varieties of the Imphee were obtained,) to be the sweetest of the Imphees; but I found the Oomseeana to be quite as sweet."

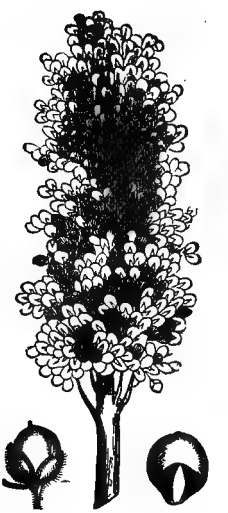


REGULAR SORGHO.

EARLY AMBER.

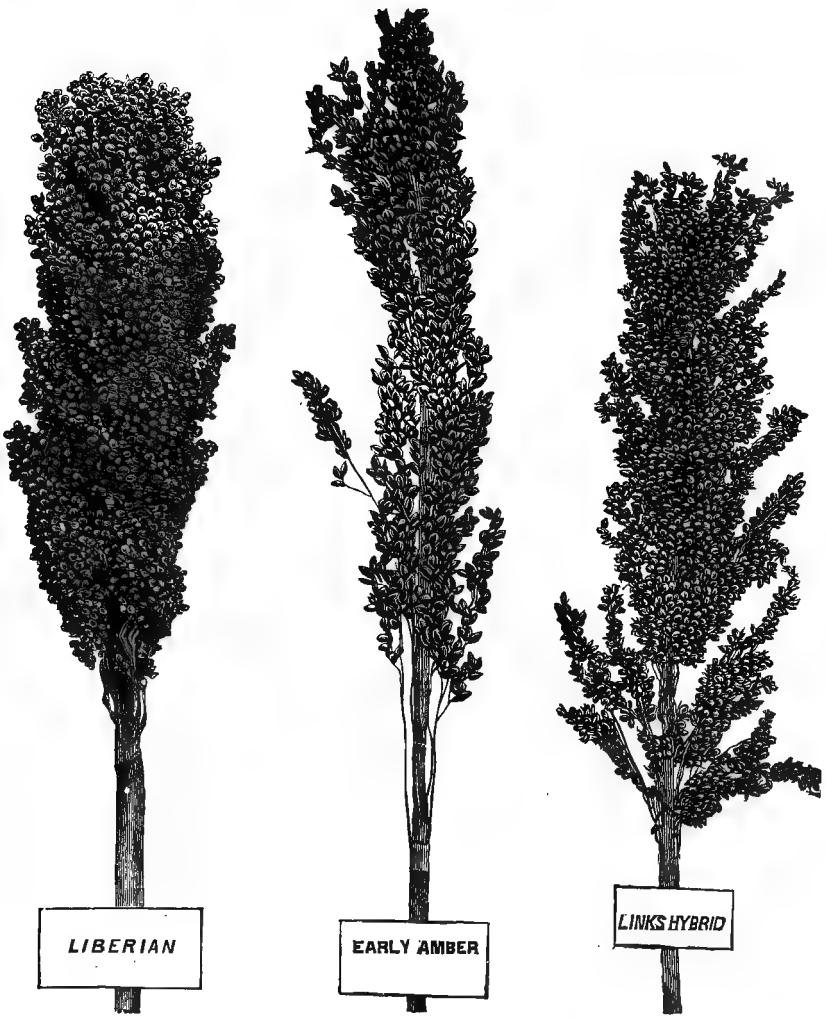


OOMSEEANA.

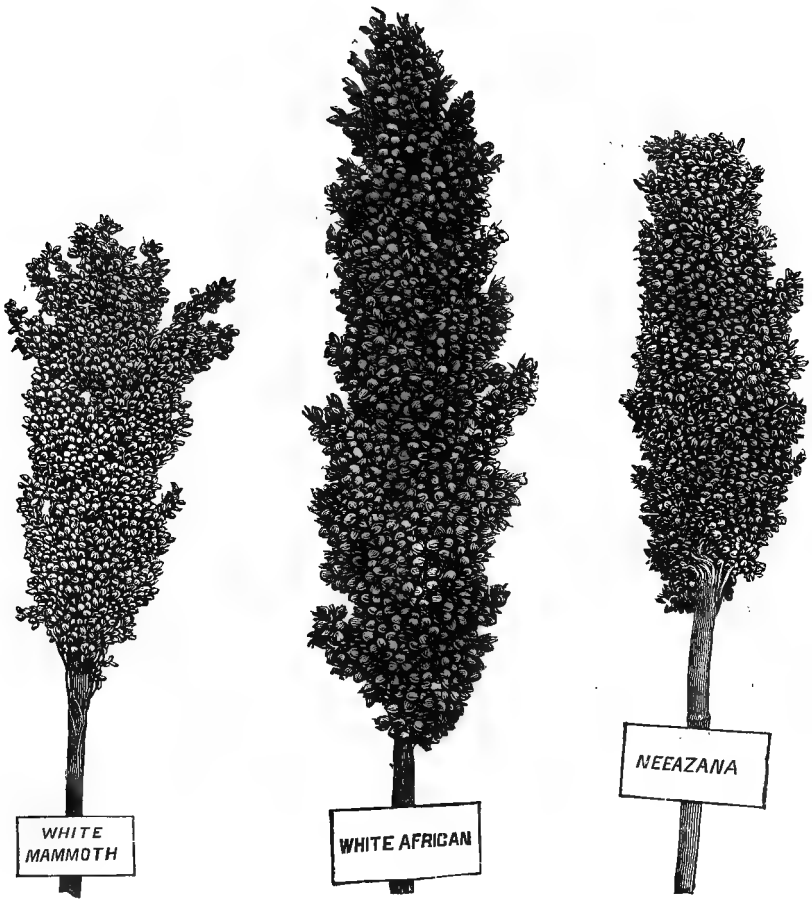


LIBERIAN.

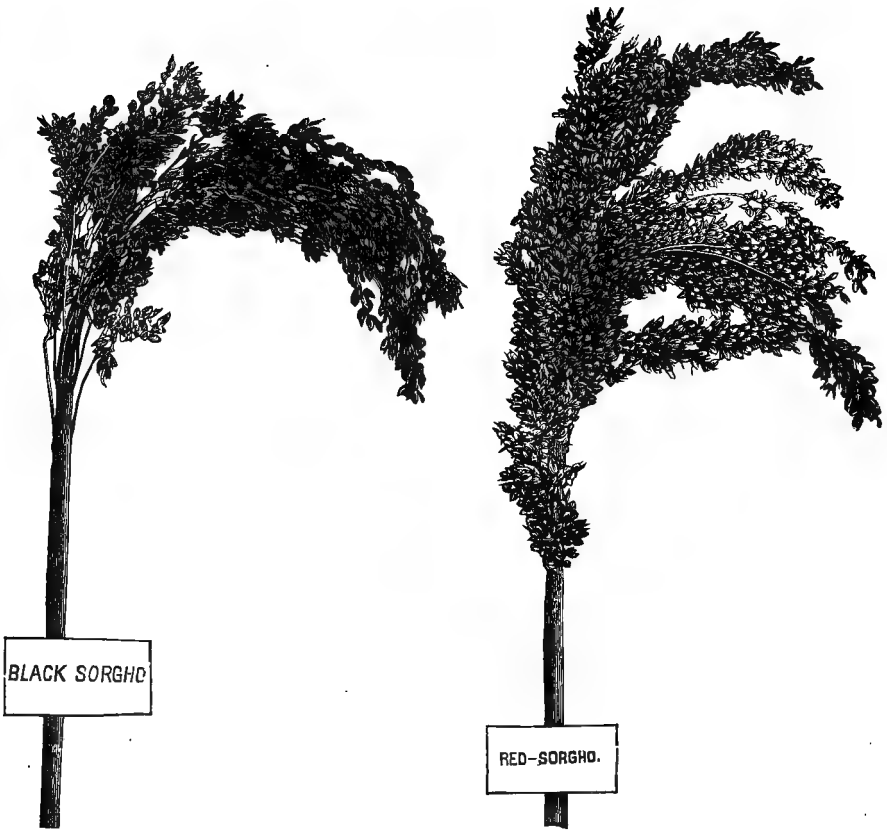
The above are accurate illustrations of the seed heads and seed of cane grown for a number of years in Southern Ohio, under our own observation.



The above varieties of the Imphee are well-known varieties grown in the United States for many years. They belong either to the original varieties brought by Mr. Leonard Wray from the Southeastern Coast of Africa, or have sprung from them. The names given these six American grown varieties are those by which they have been generally known. There is more or less confusion as to the names in different localities, the same variety going under different names.



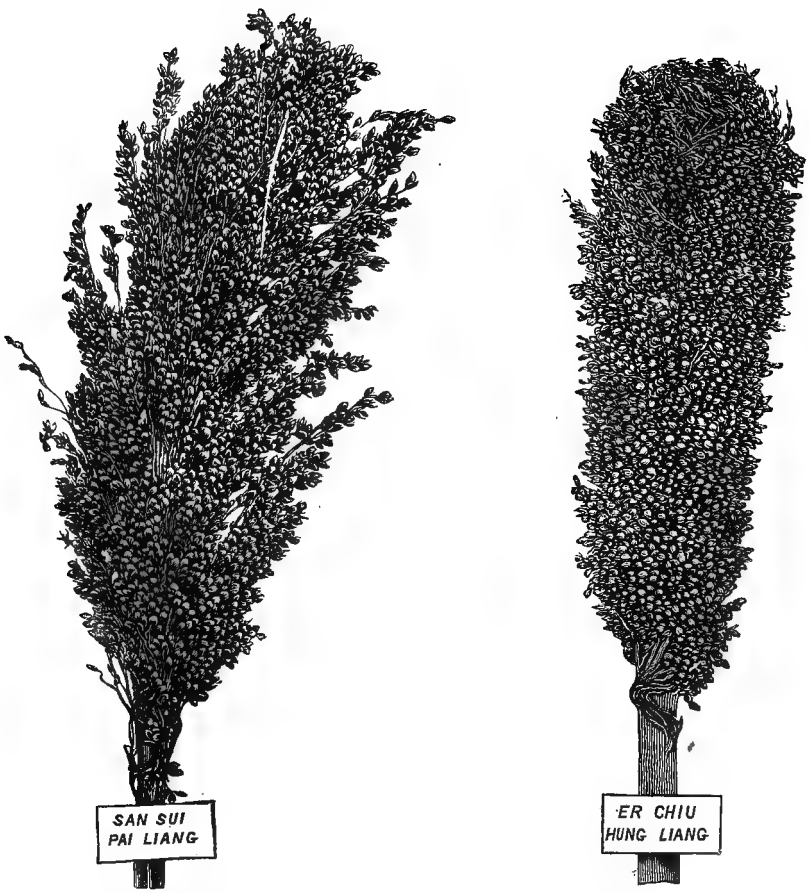
The White Mammoth, White African, and Neeazana, have been grown in this country for many years, and are well-known varieties of the Imphee.



The Black and Red Sorgho illustrated above were from Cawnpore, India.

The labels attached to the engravings (which were made from photographs) were in every case two inches by one in actual size; so that the dimensions of each panicle may be readily ascertained by using the labels as the scale of measurement.

The above are new South African varieties of the Imphees.



The above varieties are from North China.

SYNOPTICAL TABLE OF VARIETIES.

The following synoptical table of the varieties of Sorghum cultivated at the Department of Agriculture during the years 1879, 1880, 1881 and 1882, is from the comprehensive book on Sorghum, written by Dr. Peter Collier, (late chemist of the Department of Agriculture, Washington, D. C.,) and published by Messrs. Robert Clarke & Co., Cincinnati, O.

Botanical accuracy is not claimed for the table, as it has been worked out from single dry heads, and without a careful comparison of the varieties growing in the field. It is believed, however, that it will be of great assistance in aiding the practical farmer to distinguish, with the aid of the illustrations, whatever variety he may have under cultivation.

It is based upon a similar table prepared by Mr. F. Peck, and published in the Annual Report of the Department of Agriculture, 1865.

The Ripe Grain.

I. Longer than the glumes (husks).

(A.) Panicle or head dense.

I. Glumes black.

a. Inconspicuous.

Liberian, or *Imphee.*

Head short, 6 to 7 inches long, dense, cylindrical, obtuse, general color dark brown.

Glumes small, obtuse, black shining; outer one hairy on the margin.

Seed smallest of all varieties, round, obtuse, tapering to the base; hilum or point of attachment of a lighter color and prominent.

b. Conspicuous.

Seeds brown; effect of head black. (Grain at times hardly longer than the glumes.)

Oomseeana.

Head slender, erect, 8 to 9 inches long; branches closely appressed, but not dense.

Glumes black, pointed; outer one keeled, smooth and open.

Seed deep brown, and visible between the open glumes; plane convex, acute at both ends.

Black Top.

Head larger and broader than the preceding, blacker and more dense; seed lighter.

Bear Tail.

Denser head and longer glumes than in preceding, resembling in some respects a compacted Early Amber.

Iowa Red Top.

An Oomseeana cane, with large, prominent seeds and smaller glumes.

Seeds white.

White Mammoth.

Head very dense, expanding toward the flattened top.

Glumes shining black, prominent.

Seed white, large, flattened; hilum inconspicuous.

2. Glumes light-red brown.
   Seeds white.

White African.

Head slender, 7 to 8 inches long; branches closely compressed but not very dense.
Glumes large, light red, shining.
Seed large, white.
Seed yellowish brown.

Neeazana.

Head 5 to 8 inches long, dense, cylindrical.
Glumes pointed, somewhat hairy; outer one gray, inner one black, smaller and inconspicuous.
Seed long, flat; hilum inconspicuous.
Synon. White Imphee. Early Orange.
New Variety (Salle), similar to Neeazana, but both glumes are at times light colored and hairy.

Wolf Tail.

Head 9 to 10 inches long, slender, dense.
Glumes almost white, shining, somewhat downy.
Seed shorter than in Neeazana, long, round; hilum slightly flattened.

Gray Top.

Head similar to Neeazana, but glumes brown, shining, obtuse, short.
Seed short, long, large, prominent, round; hilum only slightly flattened; distinguished by its brown glumes and the prominence of the large round seeds in the head.

3. Glumes gray.

Rice, or *Egyptian Corn.*

Head heavy, bending the culm, dense, obtuse, cylindrical.
Glumes gray, prominent, wooly persistent.
Seed large, flat, white, round in outline, width greater than the length; prominent in the head, and easily shaken out.

(B.) Panicle not dense.
Glumes black.

Regular Sorgho.

Head loose, 10 to 12 inches long.
Glumes black, shining, open, displaying the seeds.
Seeds large, flat, obtuse.

Hybrid Sorghum.

Hybrid of E. Link.
Oomseeana of Blymyer.
New Variety of E. Link.
These are hybrids of the Liberian or Imphee varieties with the Honduras or Chinese varieties, and bear the characteristics of both races. Here, also, might be mentioned—
African of Parks, of Kentucky.
Hybrid of Moore.

II. Equal to the glumes.

(A.) Glumes closed, or nearly so.

Red, and palet awned.

Honduras.

Head 1 foot long, thin, loose, spreading, nodding.

Glumes reddish brown, shining, somewhat hairy, acute at both ends; inner one keeled.

Seed long, very acute at the base, obtuse at the apex; plane convex; hilum conspicuous, with a prominence at the base, and a round mark at the upper edge.

Synon. Mastodon, Honey Cane, Sprangle Top, Honey Top. These all vary slightly, so as to be distinguished in the field; but not, however, by description.

Deep chocolate palet, awned.

Hybrid of Wallis, Collin County, Texas.

Similar to the Honduras, except in the deep brown glumes and more compact head, showing its Imphee affinities.

(B.) Glumes open.

Under this head might be sought Regular Sorgho and Black Top, classed as having the grain longer than the glumes.

III. Shorter than the glumes.

(A.) Glumes black.

Culm erect.

Early Amber.

Head slender, erect; branches appressed, pointed, 9 to 10 inches long.

Glumes large, smooth, shining, acute at both ends, concealing the seed or open, flattened on both sides.

Seeds long, obtuse, light colored; hilum large, with a prominence in the center.

Synon. Early Golden, Golden Syrup.

Culm erect, or often bent with heavy heads.

Goose Neck.

Head inverted on the bent culm; somewhat loose, 8 inches long.

Glumes shining, downy at the tips, flattened.

Seeds smaller than Amber, long, acute at the base, obtuse at the apex, somewhat flattened.

(B.) Glumes purplish.

White Liberian.

Head slender, erect, or goose-necked; branches appressed, pointed.

Glumes large, smooth, shining, acute at both ends, often not covering the seed. Infertile ones often very prominent and purplish gray.

Seed large, long, and similar to the Amber, but hilum more prominent.

Synon. Sugar-cane (Barger).

BEST VARIETIES.

Until within a few years past, the Regular Sorgho was generally given the preference by planters; but of late it has been losing favor in most localities, having lost in productiveness and quality.

Of late years the Early Amber has perhaps been more generally planted than any other variety. The merits of the "Minnesota Early Amber" were first made known to the public by the Hon. Seth H. Kenney, of Morristown, Minn., one of the most prominent and successful of the Northern cane growers.

In appearance the early Amber presents some of the characteristics of both the Sorghos and the Imphees; its head being not so open and branching as the former, but more open than most of the latter. It receives its name from its ripening early, and from the bright amber color which characterizes the syrup when properly made from it. The Early Golden and Golden Syrup are kindred varieties.

The Early Amber is very rich in saccharine matter; the syrup is of a beautiful, clear, amber color, and of fine flavor, and when properly treated, produces a fine article of sugar. It is especially adapted to Northern latitudes, from the fact that it is a very early cane. It does not do as well in Southern latitudes as either the Liberian or Early Orange.

Next to the Early Amber the Liberian is probably the most popular variety. It has always been a heavy producer, and it is also desirable for its freedom from disease. It is not liable to be affected by mildew, rust or blight of any kind. It produces an excellent article of syrup. We can recommend it upon the whole as one of the best and most profitable varieties.

The Neeazana is a good Imphee, one of the best for syrups. In its general properties it resembles the Liberian; but it is peculiar in that it requires to be cut when still green, and to be worked up immediately after cutting. When thus treated it yields a pure and light colored syrup.

The Oomseeana is one of the best varieties of the Imphee, and is given the preference in some sections. It is good for sugar, but does not yield as largely in syrup as the other varieties.

The five varieties of Cane named above are all standard and reliable, and, when pure, are well defined and distinct in their appearance and properties. With the exception of the Neeazana there is but little difference in their relative adaptation to different latitudes.

The Honduras, an engraving of which appears on the last page of the cover, is one of the best varieties. Notice the resemblance of its seed-head to that of our own variety of regular Sorgho, as shown on page 9. The Mastodon and Honey Top are fine varieties, and kindred to the Honduras.

The White Mammoth and Link's Hybrid are also fine varieties.

The Early Orange is one of the best varieties. It and the Liberian are specially adapted to the more southern latitudes.

That variety should be selected which experience has shown to be best adapted to the locality and climate. It is of course important to select cane that will mature before frost. If the crop in any locality is exposed to heavy winds, those varieties having a short, heavy stalk should be chosen.

In sections where the different varieties of Sorghum have been grown for several years, the planters are enabled to determine such as are best for their particular localities. For the benefit of the inexperienced, and those living in sections where Sorghum has not yet been planted to any great extent, we give below a table showing the time required for maturity, and the height and weight of the stalk of the more prominent varieties.

This table is compiled from statistics by the Agricultural Department, giving the result of their work with Sorghum, from 1880 to 1882 inclusive, on the grounds of the department at Washington.

VARIETY.	Length of Stalk.	Weight with Top and Leaves.	Weight Topped and Stripped.	April 29th to working period.
Early Amber . . .	8 ft. 8 in.	1 lb. 7 oz.	1 lb.	96 days.
Neeazana	7 ft. 8 in.	1 lb. 6 oz.	1 lb.	113 days.
Oomseeana	8 ft. 4 in.	1 lb. 9 oz.	1 lb. 3 oz.	109 days.
Early Orange	8 ft. 3 in.	2 lbs.	1 lb. 5 oz.	112 days.
Liberian	8 ft. 7 in.	2 lbs. 6 oz.	1 lb. 13 oz.	126 days.
Honduras.	11 ft. 7 in.	2 lbs. 8 oz.	2 lbs.	126 days.
White Mammoth . . .	9 ft. 6 in.	1 lb. 12 oz.	1 lb. 5 oz.	122 days.
White Liberian	8 ft. 6 in.	1 lb. 10 oz.	1 lb. 4 oz.	92 days.
Link's Hybrid	8 ft. 10 in.	1 lb. 14 oz.	1 lb. 6 oz.	96 days.
Regular Sorgho	9 ft. 6 in.	1 lb. 13 oz.	1 lb. 5 oz.	118 days.

There is no one section where the soil and climate is equally favorable for all of these varieties, and there are many sections where both the climate and soil are better adapted to any one of these varieties than is Washington. Greater length and weight of stalk for all the varieties named, are reported from many localities. But, as these varieties were all grown under the same conditions of climate, soil and culture, and during the same period of time, the statistics given are of value as a guide to the relative length and weight of stalks, and time required for maturity.

Where the length of season will permit, the planter will find it an advantage to grow several varieties of cane, embracing both the early and late. He might select the Early Amber and Liberian, or Early Amber and Honduras, or all three of these varieties, or others. As the early varieties (Early Amber, White Liberian, etc ,) mature in 90 to 100 days, and the late varieties (Liberian, Regular Sorgho, Honduras, etc.,) mature in 120 to 140 days, he would considerably prolong his working season.

Where the time for maturing is the same, and the juice equally good, of course the heavier the cane the better. As a rule, however, the different varieties mature in proportion to the weight of the crop, and what is lost in weight is made up in the greater length of the working season.

SORGHUM CULTURE.

In general it may be said that Sorghum will thrive on any land that will produce a fair crop of corn, both plants requiring about same soil and climate. The cultivation also is substantially the same, except that in its early stages Sorghum requires more attention than corn, being more liable to be choked by weeds. After having a good start Sorghum is a vigorous plant, and will stand severe drought much better than corn. With Sorghum, however, not only the stalk, but its quality (as to richness of cane juice in saccharine properties) must be taken into account, and this is more or less affected by the soil as well as climate.

Whilst, then, broadly speaking, land that is good for corn is good for Sorghum, the *best* results can only be expected from soil specially adapted to all the wants of the latter. Whilst cane growers are generally agreed as to what is *good* and what is *poor* land for Sorghum, there is some disagreement as to what is the *very best.*

Most cane growers agree that sandy, upland soil is very good and black bottom very poor; that new land is good, especially the bright clay soil found in many sections on the skirts of timber land; that any soil that is a mixture of sand inclined to limestone, and with clay enough to hold it well together, is very good; that upland soil, moderately thick, with limestone subsoil, is excellent; that poor soil is better than very rich soil; that warm, dry soils, having a southern exposure and natural drainage, are desirable; and that clay land gives good syrup, but not so large a yield.

The soil, unless in good condition, should be manured in the fall with vegetable or rotton stable manure. This is especially desirable in clay lands. Land *freshly* manured yields poor syrup.

Plow deep and pulverize thoroughly. By throwing into ridges the soil will be better affected by frost in winter, and will dry out sooner in the spring. In general, prepare the ground as for corn. Deep fall plowing is very desirable, especially for new land, as it will put the ground in good condidition, and tend to destroy the weeds by winter freezing. If practicable, sheltered ground should be selected, as a safe-guard against the prostration of the crop. The ground should be *well prepared* and the *cultivation thorough*, so as to destroy all weeds. All *extra labor* put in during the early stages of the growth of Sorghum will be *repaid amply* in the increased value of the crop. Special care should be taken that replanting may not be required, since it is important that all the cane mature at the same time.

In the spring, after breaking up the ground by deep plowing, it should be thoroughly pulverized, and made ready for planting by clearing off all weeds and litter. It should be put in condition suitable for a garden.

We take leave of this part of our subject by adding (even if we but reiterate in other words what we have said above) with emphasis, *plow deep*, no matter how deep. The roots of the cane will penetrate several feet, and they need great depth to give the best results.

SEED.

It is of the first importance to procure pure cane seed of the best varieties. It is more profitable to pay for good seed, even a high price, than to take any other as a gift. Procure seed only from reliable dealers, who are conversant with the different varieties, or from cane growers whom you know to be reliable men, and whose cane has produced good results in quantity and quality. Cane will deteriorate in a cold climate, and should be renewed from time to time with seed from cane grown in a temperate climate, natural to its wants.

If the cane is a good variety, land that will produce 40 to 60 bushels of corn per acre ought to yield from 150 to 200 gallons syrup. The yield has reached as high as 250 or more gallons per acre. Where the yield falls below 150 to 200 gallons, it should be taken as an indication that the seed is impure; unless, indeed, the soil is not well adapted to the cane, or the season a poor one. Of course the yield per acre depends not alone upon the seed; for soil, season, climate and the percentage of waste in manufacture, all unite in determining the quantity and quality of the syrup.

As all varieties of Sorghum will mix with each other and with Doura, Broom Corn, Chocolate Corn and Millet, it is impossible to procure pure seed where they are grown together, or on adjacent lands. All admixture deteriorates the cane. In selecting seed, the richness of the juice is the proper test of quality. If practicable, and your climate will permit, procure several different varieties of seed, which mature at different periods, including the earliest and the latest. This will afford early work and a long season, and you will be enabled to determine which is the best variety for your section.

TEST OF SEED.

The seed should be carefully tested long enough before planting to allow time to procure other seed in case of its proving worthless. The time for maturing of the cane before frost is too short to make it prudent to take the risk of having to replant.

The seed may be readily tested as follows: Take a small, clean box, of any kind, with a cover (a blacking box will answer if washed clean), and fill one-half full with *clean sand;* then saturate the sand with water, and, after pouring off the excess of water, drop on the moist sand say 100 seeds, and put on the cover; then place the box with the seed in a moderately warm place or room, having a temperature of say 70° Fahr. After a couple of days remove the cover. In from three to five days about 90 out of 100 of the seed, if good, will have germinated. If a smaller proportion germinates, say three-fourths or four-fifths, the seed may be used, but a larger amount should be planted than with good seed. If a still less proportion germinates, other seed should be procured. In order to make it thorough and satisfactory, the test should be repeated one or more times. By making sure of the seed the danger and expense of replanting may be avoided.

PLANTING.

The amount of seed required is two to three pounds to the acre; if well distributed two pounds are enough. Owing to the importance of securing a good stand at first planting, it is desirable to plant twice as much seed as would be needed should all grow. In sections where cane is liable to injury by frost in the fall, planting should be done as soon as the ground is thoroughly warm. The ground should be thoroughly prepared. The planting may be done in hills or in drills, as with corn. Some cane growers advocate hills, others drills. It is claimed that with cane planted in hills the weeds are more easily kept down, through the cross cultivation; also, that the cane will stand up better against the wind.

Plant say two pounds to the acre if in hills, and three pounds if in drills. Plant ten to twelve seeds to the hill, and at the second hoeing, or say when the plant is six inches high, thin out to five to six stalks. The seed should be covered thinly. If planted early, one-half inch, or even less, is deep enough; for if covered more than that, and the ground should become cold and wet, the seed will rot. If, however, the seed is planted *late*, when the ground is warm and comparatively dry, it should be covered say three-fourths to one inch, and the earth pressed firmly about the seed. If more than say six stalks are left to stand in a hill, the yield will not be so large, nor the quality so good. Some advocate soaking the seed in warm water, or even on sprouting the seed before planting; but this is of questionable value, since in case the weather should prove unfavorable, there would be far more danger of losing the crop. We incline to the opinion that it is best to plant the seed in the ordinary condition (having of course previously thoroughly tested it, as recommended above).

CULTIVATION.

As soon as the plants come up destroy the weeds, and keep clean until ready for the plow. It is especially important to give the plants every assistance in the early stages of its growth. It is a slow grower at first, and if left alone will soon be choked by weeds. This is really the time to make the crop; *i. e.*, the first period of its growth. As soon as the rows can be followed stir the soil about the hills. After it has grown to 12 inches care should be taken not to disturb the roots. When 2½ to 3 feet high it may be turned out, as it is then able to take care of itself, and further plowing would only do damage, by cutting the roots and injuring the stalks.

It is desirable to prevent suckers from growing if possible. It is, however, doubtful whether the evil they do is entirely remedied by removing them after they once appear. The best thing is to avoid or remove the conditions that give rise to them. These conditions are undoubtedly superfluous wealth of soil, coupled with excess of moisture, causing an exuberance of vegetable growth. The most natural mode of remedying the evil pro-

duced by excess of moisture is to plant only on rolling or well drained land. With regard to the richness of the ground, it is not believed that with proper drainage there would be any difficulty from it, no matter how rich, but it would be well to plant with reference to the quality of soil, and allow as much cane to grow as it will properly sustain without suckering, so that the capacity of the soil may be fully employed in developing the true growth. By these means it is believed that suckers may be entirely prevented and the crop of cane improved.

TIME FOR HARVESTING.

As to the best time for harvesting Sorghum there is difference of opinion, some claiming that for syrup it is best to cut when the seed is in the dough, and others that it should be cut when the seed has passed through the dough state. Dr. Collier, in his book on Sorghum, discusses the subject at length, and after giving the results of numerous experiments, carefully made under his own direction when Chemist of the Department of Agriculture, gives his conclusion as follows:

"Owing to the fact that the amount of syrup which may be produced from a juice depends upon the sum of the sucrose and glucose, it is obvious that syrup may be produced from the canes in any condition of maturity; but even for syrup production, experiments have demonstrated that the maximum of syrup may be produced at the same period when the Sorghum may be most profitably worked for sugar, since at that time the sum of the two sugars is also at its maximum. For the production, then, of either sugar or syrup, it is desirable that only such varieties should be grown in any locality as may be able to reach full maturity."

We give below the opinions of some of the most experienced cane-growers:

"Cane should be cut when the majority of seeds have acquired a maturity corresponding to that of wheat when it is considered ripe enough to cut."

"The best time to cut cane is when the seed *begins* to harden, just after passing through the dough state."

"The cane should be cut when the seed is in the dough state and before it has become hard."

"The cane may be regarded as fit to cut when the seed heads have become brown. There is little doubt that the crop improves in value until the seed is pretty fully matured."

"Cane should be cut when the seed is in the dough. If wanted for immediate use it may be stripped on the hill; but it should be cut immediately after stripping; for if left to stand *after* stripping it will loose in saccharine properties. Where a severe frost is threatened the cane should be cut without stripping and laid in windrows or piles."

"Cane may be regarded as fit to work up when a majority of the seed heads have become brown. There is little doubt the crop improves in value until the seeds are pretty fully matured. But the effect of freezing the uncut cane is so disastrous to the crop, unless worked up immediately, that the utmost vigilance should be employed to avoid this result. Better cut it green (if the seed heads have shot up their full height) than allow it to freeze "on the stalk." Care and experience will enable farmers to regulate this matter."

STRIPPING CANE.

Cane growers differ as to the advisability of stripping cane before grinding. Some claim that unstripped cane makes more juice, and of unsurpassed quality; while others claim that it makes less juice, and that of a vitiated quality.

The experiments of the Agricultural Department would seem to show that unstripped cane makes *more* juice,—that the quality of juice is not so good as with stripped cane; but not sufficiently affected as to prevent making good syrup and more of it; and that for sugar, stripped cane is best.

Our own opinion, expressed in previous editions of the Sorghum Hand Book, is, that *it is best to strip the cane* before grinding; since the leaves for fodder will more than pay for the labor involved, and whilst the quantity of *juice* may be greater from unstripped cane, it will produce but little, if any, more *syrup*, and the syrup will not be as clear, or as rich, or as palatable.

The cane may be stripped standing, by means of a wooden blade, 2 or 3 feet in length; or it may be placed, two or three hills at a time, on a raking board, (about the length of the cane, having one end of the board on the ground and the other on a stool, say 2½ feet high,) and raking off with an iron rake. One man may hold the cane by the tops, and pull towards him, whilst another rakes it down; the one holding the tops can then sever them at a blow, and lay the cane in a pile. Three men can strip and top an acre of cane in a day. The cane should be carried to the mill at once after being stripped, and so should *not be stripped until wanted for immediate use.*

There are various methods of cutting and stripping cane. One plan is to throw the cane as it is cut with the heads upon a trestle provided for the purpose. In this situation the heads are conveniently cut off, and the blading is conducted with less labor than it is possible when standing. The blades are thus somewhat collected and can be readily hauled off to a convenient place for drying. The seed heads may be tied into small bundles in such a way as to admit thin hanging astride a fence, where they will cure without further trouble. The tops should be laid in piles convenient for gathering, to dry, and may be left until the grinding is over.

Another plan is to lay down say three hills side by side, cover these crosswise with three hills, and so on, until they make a pile about 2½ feet high. This raises the butts highest (as the pile nears completion the tops will be spread out fan shape), and the pile will shed rain. The blades should not be stripped nor the tops cut off until the cane is wanted for grinding. The cut cane should be protected as much as possible from rain and frost, and, when practicable, removed from the field and put under cover.

A good way to store the cane with blades on, is to tie it in bundles (not over two hills in a bundle) and cross three or four bundles to give air in the pile. If shocked up straight with the blades on, the cane will heat in one night, and cane that receives such injury is unfit for use, as the syrup is worthless. Cane cut twelve hours will be free from danger through frost.

If it is desired to grind cane with the blades on, it should be cured before grinding. If fresh cut cane with the leaves on is worked, the syrup will have an unpleasant flavor. This will not be the case if the blades are wilted.

TIME FOR WORKING UP.

In regard to this, Dr. Collier says: "The importance of working up the crop promptly after cutting can hardly be overstated, especially if the aim is to make sugar. If departure from this rule is at any time admissible, it is at least safe to say that the conditions which would warrant such departure are as yet not determined. Prompt working of the cane so soon as cut is always safe, and any delay is fraught with unavoidable risk of loss."

"It is possible there may exist certain conditions of climate and crop, when the cane may be kept even weeks after cutting without great loss of sugar, but the experiments of the Agricultural Department conclusively prove that such a course is extremely hazardous, and that the only safe course to follow is to work the cane as soon after cutting it (never more than twenty-four hours) as possible."

IMPROVING VARIETIES.

In every field of cane some stalks ripen earlier, some grow to a greater size, some are more juicy, and some richer in sugar than others. It should be the aim of every planter to select from his growing cane the individual stalks which most fully combine these qualities, and set apart the seeds which they yield for the next season's planting. And this process should be pursued from year to year, always producing from the richest, the largest, and the earliest stalks.

In selecting seed stalks from the standing cane, the comparative size and time of maturity will be plainly enough indicated to the eye; but with reference to the other qualities something more is needed, and it is with reference

to these that the most indifference or negligence has been manifested. In order to test the cane properly, each stalk, previously selected with reference to size and maturity, should be separately weighed and the juice thoroughly expressed. The juice should then be carefully tested by the saccharometer for richness, and accurately weighed for percentage or comparative volume. By these means all the essential qualities of a good rich cane may be secured, and until they are faithfully employed, complaints about deterioration may be expected.

PRESERVING CANE SEED.

It requires but little labor to select, gather and preserve all the seed that may be required by any operator for the next season's planting, and this important work should not be delayed till the hurry and bustle of the grinding season commences. Then, the probabilities are that instead of *selecting* the seed, a portion will be indiscriminately set aside from the whole stock without any reference to the quality of the particular stalks, from which it was produced.

To secure a rich variety of cane, seed should be selected from good, sweet, juicy stalks, each of which should be examined before the seed head is appropriated as a part of the stock to reproduce from. No matter if it requires the cutting and abandoning of twenty stalks for every one that is chosen; the labor will be well repaid by the improved quality of the subsequent crop. Size of stalk, early or late maturity, uniformity in size, may all be provided for, and in a great measure secured by discriminating appropriately in the selection of seed heads.

In order to cure the seed and render it safe from heating, some precautions are necessary. If seed is to be gathered in considerable quantity, it may be hauled from the field and spread upon a clean grass plat, which may remain until the woody part of the panicle is perfectly dry. Rains and frosts will not injure it.

It might, for that matter, be left on the naked ground in the field, where it is gathered, but that the heavy rains beat it into the earth, and in some cases cause it even to germinate After being thoroughly cured the seed may be thrashed or tramped out, or, as is sometimes done, passed through a grain thresher and cleaner. If it is then to be kept for some time, pack it in dry, slack barrels or boxes. Cane seed is very liable to heat and become injured if packed in large bulk either before or after being shelled. More than usual precautions should therefore be employed to put it up and keep it dry, avoiding close, unventilated packages or bins.

If planters will only take the same pains in the selection and preservation of their cane seed as intelligent farmers do in securing good seed corn and wheat, there will be from year to year a marked improvement in the crop and its product.

SYRUP MAKING.

A fine table syrup, equal in appearance and taste to the best golden syrup, and of course in every way superior to the ordinary grades of molasses, may readily be made from sorghum, and is made from year to year by thousands of operators throughout the country. This syrup is much more desirable for family use than the best refined, for it is not only *good* but it is *pure*, whilst an *unadulterated* refined syrup is seldom *if ever* to be obtained at any price.

Thousands of operators throughout the country have been obliged to add to their plants from year to year to meet the constantly increasing demand in the home markets. Many of them who began with small outfits—horse-power mills, etc.—have put in steam mills and are doing a large and profitable business. To insure such success the syrup must be *good*.

To make good syrup the cane must be of the best varieties, and adapted to the soil and climate. Care should be taken in its cultivation. It should be cut at the proper time, and the juice taken immediately from the mill to the evaporator for boiling down.

The mill, evaporator, filtering tank, coolers for the syrup and all vessels and utensils needed, should be held in readiness *before* the cane is ready to be worked up. The mill, tanks, etc., should be kept perfectly clean throughout the whole time of syrup making. The evaporator should be scraped and cleaned every day.

All tanks and other vessels in which the raw juice may be held, and the spouts through which it may be passed, should be of galvanized iron or tin. If wood is used it quickly becomes soaked and is then too hard to clean thoroughly. *Good* wood should be provided from two to three feet long (in proportion to the length of the evaporator) to secure a hot, regular fire.

The particles of cane, dirt, etc., in the juice as it comes from the mill, may be filtered out by means of a straw filter (a box or one-half barrel with straw in the bottom held down by a stone makes a simple one), or coarse cloth or strainer wire. The filter should be frequently cleaned, and the straw, hay or gravel or cloth used be washed with water to which a little lime has been added. See description of various methods of filtering, on page 34.

To make light colored syrup and syrup of the best quality, the juice must be taken fresh from the mill, filtered and properly treated with lime, and boiled down in the shortest possible time to a density of about 36° Baume, at which point the weight is 11½ lbs. to the gallon.

The Cook Evaporator, or, better still, the Automatic Cook Evaporator, will do the entire work of defecation and condensation thoroughly. In this admirable apparatus the juice passes in a continuous stream through the different channels, being defecated and condensed all the while, until it flows out a beautiful and pure syrup.

SUGAR MAKING.

Whilst there has been more or less sugar made from sorghum almost from its first introduction, and some operators have made a good article and in considerable quantity, cane growers, in general, have been unsuccessful in their efforts at sugar making. The difficulties and uncertainties attending the business, are mainly caused by the impurities peculiar to sorghum, which are difficult of separation, and whose presence prevent crystallization.

The following remarks concerning Sugar Making were prepared originally for our Sugar Hand Book, and relate specially to the tropical (ribbon) cane, but will apply equally well to sorghum.

The process of sugar making requires that the sugar existing in the cane shall be extracted and converted into solid bodies, leaving impurities behind. Experience has demonstrated that the more rapidly this is done the better the results. Immediately after the juice comes from the mill the sugar must be freed from its surrounding impurities. Its quality will depend on the rapidity and skill with which this is done.

Cane juice, on account of the acids and perishable feculent matter it contains, begins to deteriorate the moment it is exposed to the air, and the tendency of this is to destroy crystallization and to convert true cane sugar into grape sugar or glucose. Care must therefore be taken not to hold the juice in reservoirs, but to carry it at once from the mill to the boiling apparatus.

The first requisite of real and, in fact, vital importance in the treatment of the juice as it leaves the mill is,

DEFECATION,

that is, the separation and cleansing from impurities held in it. Unless this is promptly secured, failure is certain. The rough stuff can be disposed of mechanically by some such device as strainer wire, or coarse cloth, or straw filter, but the acids and other impurities held in solution can be freed only by *chemical action* and *heat.*

In sugar countries, after vainly seeking a better method of neutralizing the acids, the most intelligent sugar makers have settled down to the use of lime alone. The application of lime requires *care* and *judgment.* It must be *pure* and *fresh*, not used in its caustic state, but slacked frequently during the day, being reduced to the consistency of milk of lime. The exact quantity to be used depends entirely on the amount of acid in the juice, and must be determined by an experienced eye, or tests with litmus paper.

The *judicious* use of lime and heat in the early stages of defecation embraces the most difficult points in sugar making, and demands the greatest skill and attention. *Lime* and *heat* are the *chief agents* in defecation, but

unless properly employed *will impair* and *even prevent* crystallization. Mistakes made in the application of these agents, especially in the first stages of the process, cannot afterwards be successfully remedied.

As, next to lime, *heat* performs the leading part in defecation, its effect depends upon its prompt application and proper distribution, as well as its withdrawal as required.

On account of the rapidity with which the juice changes from exposure to the air, it is important that all the process of defecation should progress rapidly. In fact the defecation with lime and purification by heat should be combined, the juice running directly from the mill into the defecator.

CONCENTRATION.

The usual methods of concentrating or evaporating the sugar cane juice are, *first*, by the direct application of fire (as in kettles, common pans, and the Cook Evaporator); *second*, by the employment of steam (as in the ordinary trains, or the steam trains with vacuum pan). Whilst the steam train is complete in itself, a vacuum pan is often used, especially on the larger plantations, as an adjunct to it.

In Louisiana, with the tropical cane, the common method of evaporating juice has been by use of a series of open kettles, commonly five in number, hung or placed in a *row* in an arch over a fire, and called *kettle train*. The arrangement is to place the largest, called the "*grande*," or defecator, at the foot of the arch, and then have the others diminish gradually in size, towards the front end of the arch to the last and smallest in the row, called the "*batterie*" or finishing kettle.

In the kettle train the defecation is very imperfect. The scum is constantly and irretrievably remingled with the juice, and locked up by the constant ebullition, and the operation, which requires dipping from the *grande* or first kettle to the second, then from the second to the third, and so on to the last, hinders complete crystallization of all the syrup, and darkens the syrup and sugar by the prolonged boiling and imperfect cleansing. Another objection to the kettle train is, that it takes too much fuel in proportion to work done.

To lessen these serious objections, plain, flat bottom pans, arranged on the principle of the kettle train, and other arrangements of the plain pans have been employed. But no change of principle and no real improvement of importance was made till the introduction of the Cook process, which marks an epoch in open fire evaporation. Whilst the Cook pan, with its high ledges and compartments, more perfectly applies the principle of the kettle train, it retains none of its defects. It secures better defecation, more rapid concentration, improves the crystallization, affords lighter colored products, and requires less labor and fuel.

STEAM EVAPORATION.

The steam train, as used in the large sugar works of Louisiana, consists of a series of vessels of different sizes, properly proportioned, and arranged in order, and all supplied within with steam heating pipes, connected by branches with a main pipe from the boiler.

This places the successive operations of defacating, concentrating, and finishing by steam, under the immediate and convenient control of the sugar maker. The heat is readily increased or diminished or withdrawn from either vessel at pleasure.

As sugar making by a connected steam train is a continuous as well as rapid process, it is important that proper arrangement and proportions of all the parts be provided, including also the even and reliable working of the mill, so that the continuity of the operations may be harmoniously and effectively preserved to the end.

SUGGESTIONS.

It should be remembered that however effectually cane juice or syrup may be purified or refined, this will not cause sugar to be produced, if the saccharine substance in the fluid operated upon consists mainly of uncrystallizable sugar. The syrup must consist mainly of crystallizable sugar, and to insure this the attention of the operator is required to all the preliminary steps in the work. No after process will atone for any radical neglect in the previous stages.

Have the mill, vats, and all utensils perfectly clean, particularly from scraps of old bagasse and green scum. Remember that "a little leaven leaveneth the whole lump," and that cane juice is very susceptible to change, the first or incipient step of which is a conversion of crystallizable to uncrystallizable sugar. This may occur extensively before any appearance of fermentation can be detected. It is very necessary to scald the storage tanks and also the spouts under the cane mills leading to the tanks every day.

More lime is needed in refining for sugar than for syrup (since it is important to entirely neutralize the acid), and the syrup should be made to evaporate rapidly in a shallow stream, in the Cook pan, or in a very shallow body in a common pan. Reduce to density rather greater than is usually provided for common syrup.

For syrup the density should be about 36° Baume, at which point it will weigh 11½ lbs. to the gallon. For sugar the density should be about 38°, which will make the syrup weigh 12 lbs. to the gallon. After concentration the syrup should be run from the finishing pan into shallow coolers, which should be placed in a room with temperature of 90° to 100°.

If sufficiently concentrated, the syrup will be well crystallized in two days; if not, four or five days may be required. Remove the mush sugar from the coolers as soon as well granulated, when it may be drained readily by any of the ordinary means. The centrifugal drainer is the most expeditious.

CANE MACHINERY

In the manufacture of syrup and sugar it is important to secure machinery that will avoid waste as much as possible, and give the best product. After incurring the labor and expense of cultivating a crop of Sorghum and preparing it for manufacture, it is poor economy to buy machinery with a view to low prices only. The *best* is *cheapest* in the end. To make cane-growing profitable to all concerned, it is of vital importance to *save all the product*. A poor Cane Mill will waste enough juice to seriously impair if not wholly destroy the margin of profit, and in any case will waste more juice in a single season than would pay for a good mill.

CANE MILLS.

The sole object of the cane mill is to extract the juice from the cane, and that mill is best and cheapest which presses out the largest percentage of juice, with the least friction and with strength for all emergencies. Two-roll mills, rolls in wood frames, mills with *rolls arranged with levers or rubber cushions*, are wasteful, and no planter can afford loss of juice by their use.

Good work requires at least three rolls in the mill. No intelligent planter now thinks of using a 2-roll mill. The waste of juice in a 2-roll mill is so great as to use up the margin of profit in syrup making. The ordinary 3-roll mill, as made by inexperienced country founders, is not much better. The *best* 3-roll mill that can be had is the *cheapest* in the end, although its first cost may be greater than the ordinary mill.

To crush cane properly and reliably requires great power. A good mill must be strong, and, when *properly constructed*, it will be strong and safe just in *proportion to its weight*. Mills made so light that, in order to *hide their weakness*, the rolls are arranged to yield under pressure, cheat their owners.

Mills with such devices are simply *too weak* to stand heavy pressure, and however great the loss of juice to the planter, *must yield* under it or break. The planter can afford neither result. With the best flexible mill that is made the loss of juice will not be less than 10 per cent. Any one can figure how long it will take such a mill to *waste more than its price*. In most cases the loss of juice will range as high as 20 to 30 per cent.

But such mills are *not secure* even against breakage. The flexible rolls do not provide against it with any certainty. On the contrary, there are abundant proofs (which can readily be furnished) that in such mills breakages are quite numerous, and, considering the few sold, very common as compared with rightly constructed rigid mills.

In a good mill the rolls *stay where they are set*, whether the feeding is regular or not. If the mill is not evenly fed, it is all the more important that the rolls should do their duty, so that no cane can pass through until all the juice is gotten out of it When necessary to crowd the work, as often happens, the mill must be strong enough to stand it.

In ignorance of the functions and chief value of a mill, occasionally it is claimed that the *rolls run faster* and the mill runs *lighter* than others. Experienced manufacturers know that there is a certain proper speed rolls should travel, and that they can only run *fast and light* in proportion to *lack of pressure*, and consequent loss of juice they allow.

Pressure means power, and can only be produced by the exertion of power. Certainly a mill that presses out only the *free juice*, and lets a *large part* of the crop *go with the bagasse*, will run light, lighter than one doing honest work.

It requires a high degree of mechanical skill, large experience, familiarity with its practical working, and long continued tests, extending over years, to perfect a cane mill. One of the greatest drawbacks in the cane industry has been the introduction, periodically, by misrepresentations, at seemingly low prices, of mills utterly unreliable and wasteful.

MILLS FOR ANIMAL POWER.

There are two styles of Animal Power Mills in common use; one having vertical rolls, and the other having horizontal rolls. The *vertical* mill is unquestionably the *best* for animal power, since it avoids the *friction* of an *extra gear*, and a beveled one at that. The *extra gearing* required in horizontal mills for horse power increases the weight and cost. On account of the extra gearing, horizontal mills require *more power* than vertical mills, to do the same work; that is, the same animals will press more cane with a vertical mill than with a horizontal.

Of the animal power mills the well-known "VICTOR" easily ranks first. Along with other vertical mills it gets rid of beveled gear, and, in addition, has valuable features possessed by no other mill. By means of lapped gearing (which no other mill has the right to use), the return plate (variously called choker, knife and guide,) is dispensed with, and all choking or obstruction of cane avoided. The rolls are lifted from the bottom plate, and touch only at the ends of the shafts, thus doing away with much of the friction common to most mills. There is a perfect device for oiling the journals. It has a good feed-box, flanges to the rolls, and other conveniences, such as channel in bottom plate to receive the juice from the rolls and conduct it to the spout, wipers to keep the faces of the rolls clean, screws for regulating position of the rolls. The "Victor," in short, is the most complete and desirable of the animal power mills, being superior in construction to all others.

The *Great Western* has been favorably known for many years. Next to the *Victor*, it is the best horse power mill made in the country. Although not quite so heavy as the Victor, it is a good, strong, well finished mill, and gives the best of satisfaction to purchasers.

STEAM MILLS.

The leading mills for steam or water power are the HORIZONTAL VICTOR and the NILES Mills.

The Horizontal Victor has the same plan of dispensing with the return plate between the rolls which has given such a celebrity to the Vertical Victor. These mills are made extra heavy and strong, and are of the best design, metal and workmanship. They are especially adapted to the wants of planters who want mills of from four to ten-horse power. They have been recognized standard power mills for many years, and are in use in all syrup and sugar producing sections of the world. It is by far the best small power mill made, in material, construction and finish.

The Niles Mills were first introduced into Louisiana for crushing sugar cane over 50 years ago, and have ever since been the standard mills in that section. These mills range in size from the smallest (with rolls 16-inch diameter by 16-inch length, weight over 7,000 lbs.,) to mills with rolls 34-inch diameter by 72-inch length, weight over 150,000 lbs., and upwards. Over 500 of the Niles Mills have been sold in Louisiana alone. As this mill has held its ascendency for so long a period, and still maintains it, there can be no doubt concerning its superiority. Nowhere in the country are the qualities that constitute a good cane mill so well understood as in Louisiana. Nowhere else have cane mills been so long in use, and subjected to such severe tests. Nowhere else is so much science, skill, and capital brought to bear in the selection of sugar machinery. In short, nowhere in this country are the planters so well posted on cane mills as in Louisiana.

EVAPORATING APPARATUS.

For many years the Cook Evaporator has been the most popular and successful for fire service. Indeed, the existence to-day of the Northern cane industry is mainly due to this remarkable invention. Its use has become well-nigh universal.

But notwithstanding its superior advantages, there have been points which our long experience with it demonstrated could be improved; and from time to time, within our own operations, these points have been improved, and practically and thoroughly tested, and then patented.

These improvements have necessarily increased the cost and price of the Evaporator, but planters can well afford to pay the higher price for the more perfect apparatus. The Automatic Cook was first introduced to the public seven years ago (after several years' test in our own hands) and since then a large number have been sold, and its popularity is steadily increasing.

This Evaporator preserves the good qualities of its famous forerunner, but *saves most of the labor of skimming*, makes *more syrup* with the *same fuel*, *increases the yield of syrup*, from a given quantity by securing a re-separation, and *improves the quality*. It is the most perfect pan ever devised.

The *Automatic Cook Pan* has three divisions, each performing separate offices, and all connected by high ledges and gates under the full control of the operator. The *first division* frees the juice from its crude impurities, whilst passing through the channels, by the automatic action of the skimming device, which throws the scum in an opposite direction from the moving juice. In the *second division* the juice is freed from its remaining impurities and reduced to semi-syrup. The semi-syrup is taken by the *third division* and finished as rapidly as possible to the sugar point, and drawn into coolers.

This arrangement, which is pronounced the most perfect possible for open fire evaporation, we especially advise for all the larger operators not provided with steam. It combines conveniently and successfully provisions for *defecation, concentration and finishing.*

VACUUM PAN.

There are two forms of the Vacuum Pan in use. In one the vacuum is formed by a jet-condenser, and in the other the vapor is drawn off by a separate Vacuum Pump. The former is called a *wet* vacuum and the latter a *dry* vacuum.

The Vacuum Pan is commonly made of cast iron or copper, and in general outline somewhat resembles a still. It has a *circular body*, with *bottom of pan shape* (to which is attached lugs to support the pan), and a *dome top.* From the dome extends the *vapor pipe*, the *overflow*, and the *condenser* (which in the wet vacuum is placed close to the Pan and connected to the Vacuum Pump).

The heating is done by steam introduced through copper coils, the number and diameter being governed by the size of the Pan. *Eye glasses* are provided in the dome and side of the Pan, through which the action of the boiling syrup is observed; the Pan is also provided with *vacuum gauge and thermometer, test cup and proof stick*, by which to examine the work as it progresses. When finished the contents of the Pan are discharged through a large valve in the bottom of the Pan. Vacuum Pans range in price from $1,000 to as high as $10,000.

The capacity of the Vacuum Pan is estimated by its diameter and height. The diameter varies from four feet in the smallest size to nine feet and over in the largest sizes.

We give above description of a Vacuum Pan, as many sorghum growers have but a vague idea of its construction. It is not needed for making syrup, and can only be used profitably in sugar making on a large scale.

DIRECTIONS.

Plain Directions for setting up and working our Mills and Evaporators are sent to each purchaser, and these directions are so full and explicit that any one of ordinary intelligence can carry them out without any difficulty.

FILTERING CANE JUICE.

Some of the impurities with which cane juice, as it comes from the mill, is loaded, exist in a state of solution. In this condition they are absolutely inseparable from the fluid. But, there are other foreign matters, consisting of fragments of cane, clusters of minute juice cells, washings from the stalks, etc., which are mechanically suspended in the juice, and which may be removed by filtration. A portion of these substances will in time settle to the bottom, and others will rise to the surface; but, by far the largest part remain for a long time floating in the juice, giving it a dense turpid appearance. The particles are too small to indicate themselves separately to the eye, and by an ordinary process of filtering they either pass through without being arrested, or, if obstructed, the filtering substance soon becomes clogged and matted, stopping the passage of the juice. It is extremely desirable to remove as much as possible of these insoluble matters from the juice before it goes to the pan. Some of them, if allowed to remain until the juice boils, impart an offensive taste and color to the syrup; other portions are dissolved by heat and remain permanently in the juice, and others operate to destroy the cohesion of the scum, so that in place of coming off in well matted consistent masses, it becomes disintegrated or broken up into fragments, which again mingle with the juice, and do not afterward appear on the surface. We feel confident the importance of filtering the juice well, as a first step in the operation, is not sufficiently regarded. By filtering we do not mean simply passing the juice through a coarse sieve or riddle, or the ordinary plan of passing it through a tub or box filled with straw. The juice at first percolates freely through, in small, swift currents, leaving only the larger masses of matter on the top of the straw, or entangled in its meshes, while the fine particles are all carried down by the current. Gradually the smaller interstices in the straw become filled or clogged, and the juice finds its way only through the large openings. Soon these become stopped and the filter begins to overflow, carrying over into the tank much of the coarse trash which has been deposited on the top of the straw. Presently the operator discovers what is going on and plunges his hand into the filter and raises and loosens the straw, so that the juice again flows through freely. By this means he succeeds in liberating most of the substance which has been previously separated and allows it to be washed through into the tub. After awhile another overflow and another washing down is performed, and so on through the day. The operation is obviously absurd; and, as much as we favor filtering, we cannot allow that this is much better than running the juice direct from the mill to the pans. We will describe a simple apparatus in which they are practically embodied. It consists of an oblong box, say for two or four horse mill, six feet long and fifteen inches square on the inside. Fill it with clean, bright straw, well crowded in. Bore two holes in or near one end, one near the top and the other near the bottom of the box. Insert a hollow plug in the upper one and a hollow plug with a spigot in the lower one. This completes the apparatus. Allow the juice to run from the mill into one end of the box and let it fill until it flows out through the upper hollow plug at the other end of the box. By this means the juice percolates through the straw for six feet, and in an area the cross section of which is fifteen inches square. The result is, the current in the box is so slow as to be almost imperceptible; the suspended matter is left adhering to the straw all through the space, and nowhere does it collect and form an impervious mat. The whole success of this apparatus depends upon keeping the box full of juice, and drawing from the upper plug in place of the one near the bottom. If the juice is taken from the lower plug the apparatus becomes like any other filter; the juice runs through in swift currents, the straw presently becomes clogged, and the operation, so far as filtering is concerned, may as well be abandoned.

Once a day the juice contained in the box may be drawn off, very slowly, through the lower plug, and the straw passed through the mill, to express the suspended juice, and the box cleaned out and filled with fresh straw. In cool, clear weather this will not be required daily, but it should not be deferred more than two days. The juice comes off remarkably clear and transparent and the results of the filtering are apparent in the appearance of the scum, and more than all in the ultimate quality of the syrup.

Another cheap and efficient filter is made by having a box about 30 inches deep, 30 to 40 inches square at the top, and tapering to 20 to 30 inches at the bottom. About four inches from the bottom a false bottom is placed, perforated with holes, and upon this coarse gravel, covered by layers of increasing fineness in succession to the top, which is clean, fine sand. The juice is admitted into the open space below, under a slight pressure, and, filtering upward through the gravel and sand, escapes by a pipe above.

In case the filter becomes stopped up the fluid contents may be removed by a stop-cock, which is inserted into the open space at the bottom, when a pail or so of water will wash out the accumulated impurities. This filter should be thoroughly washed with water when not in use, and a little lime should be added to the last washings to avoid fermentation.

DEFECATION WITH LIME.

Lime is an important aid to defecation. It is not used to neutralize the acids, except incidentally. The acid is expelled in a great measure by heat. Its effect is to coagulate and separate a class of impurities which heat alone fails to remove. It prevents the development of that clotted substance in the syrup called jelly. It gives the syrup a clear, amber color, entirely different from that dull, milky or cloudy appearance which is nearly always observed. But in using lime the utmost care must be employed. It should be stirred up with water and allowed to stand a minute or two until the heavy particles subside and the fluid acquires about the color and consistency of new milk. Then add to the cold juice in the tank or receiver, at the rate of about two or three gills to every fifty gallons of juice, and stir it thoroughly until it is perfectly incorporated with the whole. If you have litmus paper, (a little roll, enough for a whole season costs but twenty-five cents,) dip a narrow strip into the juice before adding the lime. It will turn the paper red. After adding the lime, dip the other end of the same strip into the juice and compare the two ends. If the color produced by the last test is a little less red than the first, bordering more on pink or purple, the lime has produced an effect and no more is needed. If, however, you can discover no difference in the hue of the paper, a little more lime may be added and the test repeated. We have seen juice that did not indicate the presence of free acid, the litmus paper not being changed; but this is rare; acid is almost always indicated. We think if you use lime in this prudent, cautious way, you will find great advantage in it. But if you allow "the boys" to have a tub of whitewash, with permission to stir it up from the bottom and immediately bale in any quantity that their fancy or indifference may permit, you will see nothing but its mischievous effects, and probably join with others in the indiscriminate condemnation of the whole thing. It is a good plan to mix the charge of lime with a bucket of juice before putting it into the receiver, and delay adding the lime until just before the juice goes into the pan, in order to secure the full combined defecating effect of both the lime and heat. Remember that coagulum, if properly separated and managed, locks up and brings off the insoluble floating particles which are also contained in the juice. It operates precisely like eggs, milk, blood, and other substances which are frequently added for the purpose of clarifying, and the aim of the operator is not simply to remove this coagulated matter, but also the insoluble impurities with it. As the amount of lime which is approximately correct will soon be known, the additions at first may be more rapid than at the close; but, as the point of neutralization is approached, the greatest care should be exercised to avoid an excess. Should too much lime be accidentally added, a little more fresh juice may be brought into the defecator, although with care this will very rarely be necessary.

Many experiments have been made for the purpose of learning at what temperature the lime should be added, and there appears to be no difference whether the lime is added to the juice at the ordinary temperature, or at any point under boiling. Owing to the possibility that the acids of the juice may cause the inversion of some of the sugar after the heating is begun, also in order to have ample time for adding the proper amount of lime before the boiling point is reached, it would seem to be desirable to add the lime as soon as possible after turning on the heat. If an excess of lime is used, it will result in giving a darker color to the juice and to the syrup produced from it.

After having withdrawn the heat, the contents of the defecator are left at rest for from fifteen to twenty minutes, after which the scum may be carefully removed by a large skimmer, pierced with holes not over one-sixteenth of an inch in diameter, and this scum may be emptied into a gutter upon one side of the defecator, by which it may run to the scum tank for future treatment.

It has been the practice of many to draw the contents of the defecator immediately after skimming into settling tanks, where it is allowed to stand, as in the defecator; but it would seem desirable to have two or more defecators in use, so that they may take the place of settling tanks, and thus avoid the necessity of disturbing the juice during the subsidence of the sediment.

The following extracts are from the correspondence of some of the most experienced and intelligent cane growers throughout the country. We would be glad to have reports and suggestions from every such in regard to the cultivation of Sorghum, harvesting, seed, fodder, etc., and to give a summary of the same in our next edition.

SEED, FODDER, &c.

Griddle Cakes.—"For griddle-cakes it is nearly equal to buckwheat, and mixed equally with buckwheat no difference could be detected. For ginger-cakes it is excellent. As feed for cattle, horses and hogs it has no equal. There is no grain that will make a horse gain in flesh faster. For milch-cows a farmer cannot estimate its value till he has tried it. It is especially valuable for young stock and calves and for hogs. I know that it is worth more per bushel than corn; and when I say more, I mean that there is a great difference."

Feed.—"In the spring of 1881 we killed a hog that had been fattened on cane-seed. The meat was as hard and sweet as I ever tasted. This hog was fed on nothing but cane seed and water, yet it took on flesh faster than any hog I ever fed. Some farmers complain of the expense of harvesting it. Now, does it pay to pick up an ear of corn after it is husked and thrown on the ground? One head of cane seed will yield as much feed as an average sized ear."

Food.—"I have seen many questions regarding the use of cane seed flour for griddle cakes, that can be fully answered from the experience of this company. Cane seed is worth more for flour than for anything else. It is a great improvement on buckwheat, as it is finer food and more nutritious. We own a large flouring mill and have given the question a thorough test, both in 1881 and 1882. The flour is put up in 12-pound sacks, and retailed by our grocers at 50 cents per sack (same as buckwheat flour). We have also mixed it with oats and ground it up into chop-feed. It is as good as corn for feed."

Seed.—"The value of the crop (sorghum) is considered to be mainly in the sugar; but the seed is found to be about equal to Indian corn in feeding value, and the crop per acre is not less than that of other common cereals. There are no good feeding experiments to show what may be the value of stalks from which the juice has been extracted. The field for enterprise in this direction is a large and inviting one.

There is no difficulty in saving the seed, as the heads can lie upon the ground a long time, unless there is an excessive amount of rain. The heads can be drawn and spread on the barn floor, or, what would be better, arranged on racks in a shed like broom corn. Some bind the heads in bundles and stand them on end in the field, like bundles of wheat, to dry."

Leaves.—"It will be seen that leaves have a composition which shows them to be of very great nutritive value; and, as fodder, they are well worth preserving whenever one strips his cane for the mill. Indeed, their value is such, that, if carefully preserved, they would easily repay the cost of stripping.

It appears then, that the leaves of the sorghums have a higher nutritive ratio than our grasses or hay, and there is present in them, when dried with care, a large percentage of sugars and albumenoids, two of the most important constituents of animal food."

Culture.—"I prefer shocking the cane as fast as it is cut, and allowing it to stand ten or twelve days before it is worked. Never heard of cane injuring in shocks, even when made very large, say five or six hundred pounds in each. If put into buildings, laid horizontally in large heaps, it will heat. Think this is the most unsafe way of storing cane. I set it up as it is cut, on the ground, butts down. The clay and dirt adhering to the ends do no harm. Freezing ripe cane in the shock does not injure it. The syrup may be a little darker, but the taste is not affected. Green cane is greatly injured by freezing. I cut and shock when the majority of the heads are ripe. In topping Sorgho, cut off from two to three feet, not quite so much from Imphee. Don't strip the cane until ready to grind. Shocked my cane last season on the 11th of October, and it remained four weeks before being worked. Not so much labor to work cane that has been shocked; less time and fuel required to evaporate, and less labor and loss in skimming; but the rolls of the mill will require to be set closer. If cane is green and ground too close, the crude sap from the rind and joint is pressed out, injuring the taste of the syrup. When cane is shocked, the fodder cures and is all

saved and is worth enough to pay expenses; but, if stripped in the field, while the cane is standing, it costs more than it is worth to save it. If I did not shock the cane I would throw it into large piles, and pull out the stalks, two or three at a time, which will strip off most of the blades."

Time to Work.—"Cane should be pressed about as soon as ready to work. I have heretofore worked my neighbor's cane and lost my own. That is not good sense. I prefer to cut off the heads in the field, where the seed will do better than anywhere else until cured. Rain won't hurt it. If my neighbors want their cane worked, and are willing to wait till I am ready to work it, I will advise them to cut it up with the blades on, and haul it to their barns or sheds, and leave it there until it can be worked. Should not be stripped until ready to grind, as the leaves keep it open and cool, and is much safer. But, if I could have my way I would always work it as fast as it is cut. I am not in favor of this shocking. I have worked cane that has been kept this way and found it shocking dry—not a drop of juice in it."

Topping.—"I think it best to blade and top before cutting; curing the blades and heads for feed. After this, cut the cane and tie in bundles with a straw band near each end; this makes it very convenient to load for hauling to the mill. I fatten my hogs on the green scum, and use the bagasse for bedding horses and cattle; like it better than straw."

Save Your Fodder.—"We ought to save all the product of the farm which can be used as food for ourselves or our stock. The tops of our sugar cane, according to my experience, make excellent feed for cattle and sheep; but in general, this portion of the sugar cane crop, which I believe is as valuable as the other, is left on the ground to go to waste. To those farmers who have a short corn crop the coming season, I would say, try the experiment.

"When topping your cane cut off the two upper joints, or more. If the cane is very tall, lay the tops on the ground evenly, between the rows, in small piles, and after the cane has been cut and hauled off, which should be right away, shock the tops up the same as you would corn fodder. It will require but little more time to do it this way than to let the tops lie on the ground, and if the seed is not injurious to stock, it will be a valuable addition to the farmer's supply of corn and hay."

Green Fodder.—"Indian corn requires a rich soil, and one not liable to suffer from severe drouths, to make a really good growth of stalks for cutting for fodder, green or dry. Sorghum, if the soil be well worked and not weedy, will, in many places, furnish more fodder and of nearly as good quality, especially in dry seasons. There is not so much need of care in selecting the seed, and this crop if it gets a good start will bear drouth very well. It should be sown in drills about two feet apart. The ground should be deep, mellow, and free from weeds. When the seed first comes up, the little plants are hard to tell from grass, and are liable to be choked, hence clean land is very desirable. It is cut and cured like corn stalks."

Vinegar.—"There is no difficulty about the vinegar—it makes itself. Set the barrels, containing the sour juice, with any washings or skimmings you may have, in a warm room, or in the sun, if the season is not too much advanced. If more convenient it may be kept (secure from freezing) until spring, and then exposed to the sun. The rapidity with which acidification takes place depends mainly upon the temperature. It may, however, be accelerated somewhat by adding a little yeast or some vinegar. The yeast becomes more necessary if the juice has been to any extent defecated and deprived of a portion of its natural ferment. After the vinegar is well developed draw it off from the dregs. It will probably be cloudy. If so, filter it through clean sand. If color is wanted add a little burnt sugar. Sorgho sugar is unexceptionable. It has a clear, pleasant taste, and is highly prized by all who have used it."

To Remove Scale.—"If the deposit consists of a white substance not very thickly coated, and not burned or carbonized, it may be removed by washing with water, to which one tablespoonful of oil of vitriol (sulphuric acid) to a gallon has been added. Or, if some sour skimmings be left in the pan over night it will loosen the deposit. If the substance is burned to the pan it may be loosened and made to scale off by smearing the bottom with lard, and warming it up with a little bagasse fire. If the bottom is of galvanized iron, with soldered joints, care should be taken not to raise the heat high enough to melt the solder."

MANURES.

The word *manure* originally signified laboring with the land, and to the farmer should still retain some of the old meaning, as incorporating the enriching elements with the soil is exceedingly necessary.

However numerous and different may be the materials which assist the growth of plants, judging them by their origin, character, and names, they only consist of about a dozen varieties of matter.

These are carbonic acid, water, ammonia, sulphuric acid, phosphoric acid, potash and soda, silica, oxide of iron, chlorine, lime and magnesia. These are the elements of vegetable nutrition, or the essential plant-food. In a fertile soil *all* these materials are accessible to the plant, and if *one* of them be absent the soil is barren, and if a substance that combines the missing article be applied to the soil it will be rendered fertile.

Soils are often unfertile from other causes, such as the absence of water to dissolve the food of the plants, or because the stores of the plant-food are locked up in insoluble forms. Lime and the products of vegetable matters often fertilize merely by their solvent action on the soil. Gypsum or plaster also acts as an absorber of ammonia.

Lime, marl and muck are also often applied merely for the purpose of rendering the soil lighter, warmer, more or less retentive of moisture, etc., apart from any food they may furnish to the plant. Thus manures are valuable as agents to assist the plant in obtaining its food—as important a qualification as that of being food for it.

For this reason, also, one fertilizing agent has no absolute and invariable superiority over another, as all are equally indispensable, and the superiority that a special composition may be said to possess depends upon the soil to be recruited. In some districts *lime* is esteemed most highly as a manure, and, on a clay soil, it may, 1st, mechanically destroy the coherence and tenacity of the clay; 2nd, chemically decompose the clay, making potash, ammonia, etc., soluble; and 3rd, it may be directly absorbed by the plant. In other places plaster (sulphuric acid and lime) is chiefly depended on; in other districts superphosphate of lime, etc.; consequently, the intelligent farmer should know what element is most required in his soil to make it productive.

No one manure contains every fertilizing element; and lime, plaster, salt, etc., which contain but few ingredients, can not in general be depended on for continuously feeding the soil or maintaining its fertility.

The more ingredients any manure contains or can supply to vegetation the more useful it is, and there is none so *universally* valuable, or contains so many of the elements of plant-food, as stable *manure*. Swamp muck, straw, and vegetable refuse, however, are of a very similar character and should be very carefully collected and preserved for the soil. To these elements, which are abundant everywhere, we wish to call attention, as their value is very greatly overlooked by our farmers generally.

Swamps and marshes are formed by depressions in the land, into which the water from the higher points flows and there remains until evaporated by the atmosphere or is drained off through channels either natural or artificial.

This water carries with it, in passing to the swamp, great quantities of most excellent plant food, and will, unless it is returned to the land, soon exhaust it and make it barren. The early part of the year is the best time to collect this rich deposit and prepare it for the field; and that the water may drain from the muck, it should then be spaded up and wheeled or carted out to the soiled or higher ground, or stable-yard, a process which will doubtless appear to many exceedingly laborious and one that "will not pay." To this, however, we reply, that such "diggings" have yielded to some parties more gold than many that have been well worked in the famous Eldorado, and for this reason the muck obtained therefrom, when composted or mixed with the urine and excrement of stock about the stables, makes one cart load of manure equal to about three of the ordinary material. This is because it is such a powerful absorber or fixer of ammonia, one of the essential elements of plant-food.

Probably the most economical method of using it is to compost it or mix it with the stable manure, as it absorbs from the dung and urine their ammonia and they again develop the inert fertilizing qualities of the muck.

To a given quantity of stable manure two or three times as much weathered or seasoned muck may be used. The manure may be either removed from the stables and daily mixed with the muck by shoveling the two together, or, as some excellent farmers prefer, a trench, watertight, four inches deep and eighteen or twenty inches wide, is constructed in the stable floor, and every morning a quantity of muck is placed therein behind each animal, so as to absorb the urine as well as the excrement, both being greatly improved by their reaction on each other. The quantity of muck to be thus used should be at least sufficient to absorb all the urine and moisture from the manure, and when the compost is removed from the stable it should be well intermixed and thrown into a compact heap, and covered with a layer of muck several inches in thickness, in which condition it will not require any shelter if used in the spring.

CLEANING PANS.

Pains should be taken to keep the Evaporator clean. If a scale is permitted to form it will burn and impart a burnt taste to the syrup. Vinegar boiled in the evaporator will help to clean it. Muriatic acid one part to seventy parts of water is good for cleansing copper, but good vinegar will be found useful. It should be boiled half an hour, and any place where it fails to remove the scale it must be taken from the pan with a chisel or some sharp instrument. This lime deposit should never be left till it burns on, as after that it cannot easily be removed, besides it is a great injury to the syrup. When the bottom of the evaporator coats over with soot to any great extent, it should be removed at least once a week, or else much of the heat will be lost.

CONVENIENT ARTICLES.

Saccharometer.—This is a delicate instrument, consisting of a weighted bulb and a stem five or six inches long, so graduated as to indicate in figures the quantity of sugar in any solution, according to the scale suggested by M. Beaume. It is used by dropping it into a deep test cup containing the liquid to be tested. It will sink to a certain point and there remain at rest. The number of degrees of the scale which appear above the surface of the fluid marks the density in degrees. In soft water the Saccharometer will sink to zero; in cane juice it will mark from 5 degrees to 10 degrees, according to the richness of the juice, the higher figures indicating richer juice; in syrup it will mark from 6 degrees to 40 degrees. Boiling hot juice will show 2 degrees to 3 degrees less than cold juice, and boiling hot syrup about 4 degrees less density than when cold. The temperature for which the scale is graduated is 60 degrees.

Test Cups.—These are tin tubes (one end closed), 10 inches in length, and 2 inches in diameter. They are for the purpose of using in connection with the saccharometer.

Test Tubes.—These are small vessels about five inches long and three-fourths of an inch in diameter, made of white French glass. They will hold half a dozen spoonsful of juice or syrup, and when filled may be held in the flame of a lamp, or on a bed of coals until the contents boil. The best method of using them is to make a round loop at the end of a piece of wire, by which the tube can be held in the fire, using the wire as a handle.

Swing Pipe.—This consists in a pipe in the inside of a defecator reaching from the top nearly to the bottom, connected at its lower end by an elbow with a short pipe arranged at right angles, and extending out through the side of the defecator. With this arrangement the long part of the pipe can be made to swing or rotate down, so that as its mouth sinks below the surface of the fluid, the latter may flow off through the pipe always from near the surface. By this means the clear liquor may be all drawn off down to the sediment, without disturbing the latter.

Litmus Paper.—Litmus paper is used to reveal the presence of acid or alkali in juice. A strip of *blue* litmus paper, upon being dipped into cane juice, or any fluid containing *free acid*, will be changed from *blue to red*, the red color being more or less in proportion to the quantity of acid present. As small portions of lime are successively added the color produced will be less intensely red, until finally, when the fluid is perfectly neutralized, no tint of red will appear. If an *excess of lime* be added to the fluid, rendering it *alkaline*, the *red paper* will be changed to *blue*, more or less intense, according to the excess of lime present.

Milk of Lime.—Milk of lime may be prepared by slaking in boiling water, using an abundance of water, enough to form a thin wash. After the lime has been slaked, and stirred up well with the water, allow it to settle, and then pour off the clear water. Repeat this operation with freshly added water, once or twice, then add water and stir in thoroughly, and after it settles pour off the milk of lime for use, rejecting, of course, the sediment at the bottom. The vessel containing the lime should be kept covered so as to exclude the air as much as possible.

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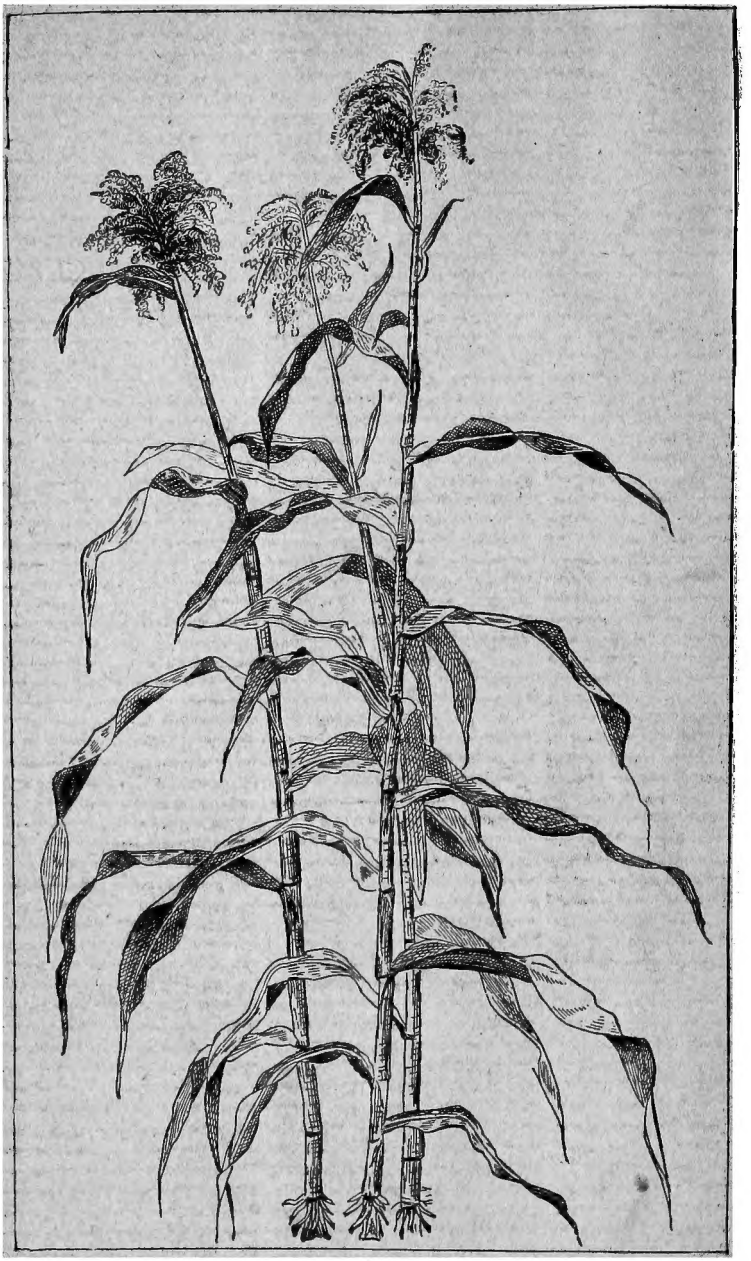

HONDURAS SORGHUM.